

Before the  
Federal Communications Commission  
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Part 2 of the Commission's Rules	)	
to Allocate Spectrum Below 3 GHz for Mobile	)	
and Fixed Services to Support the Introduction of	)	ET Docket No. <u>00-258</u>
New Advanced Wireless Services, Including Third	)	
Generation Wireless Systems	)	
	)	
Amendments to Parts 1, 2, 27 and 90 of the	)	
Commission's Rules to License Services in the	)	
216-220 MHz, 1390-1395 MHz, 1427-1429 MHz,	)	WT Docket No. 02-8
1429-1432 MHz, 1432-1435 MHz,	)	
1670-1675 MHz, and 2385-2390 MHz	)	
Government Transfer Bands	)	

**SEVENTH REPORT AND ORDER**

**Adopted: October 14, 2004**

**Released: October 21, 2004**

**By the Commission:** Chairman Powell issuing a statement.

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## I. INTRODUCTION

1. By this action, we continue our efforts to make spectrum available for new advanced wireless services ("AWS"), including third generation wireless ("3G") systems. The actions taken in this Seventh Report and Order are specifically designed to facilitate the introduction of AWS in the band 1710-1755 MHz – an integral part of a 90 MHz spectrum allocation recently reallocated to allow for such new and innovative wireless services.<sup>1</sup> We largely adopt the proposals set forth in our recent *AWS Fourth NPRM* in this proceeding that are designed to clear the 1710-1755 MHz band of incumbent Federal Government operations that would otherwise impede the development of new nationwide AWS services. These actions are consistent with previous actions in this proceeding<sup>2</sup> and with the United States Department of Commerce, National Telecommunications and Information Administration ("NTIA") *2002 Viability Assessment*, which addressed relocation and reaccommodation options for Federal Government operations in the band.<sup>3</sup>

2. This Report and Order accomplishes two main tasks. First, we allow Federal Government users access to new frequencies – generally grouped into frequencies in the band 2025-2110 MHz ("2 GHz") and frequencies in the band 2360-2400 MHz – that will allow Federal users to relocate existing operations in such a way that will ultimately free spectrum for these users to relocate operations from the 1710-1755 MHz band. Second, we address the relocation procedures and policies that are necessary to make these relocations of Federal Government users possible.

3. Specifically, we herein adopt the following spectrum allocation decisions:

- We allow the U.S. Department of Defense ("DOD") to use the band 2025-2110 MHz, on a co-equal, primary basis with non-Federal Government operations, for earth stations at 11 sites to support military space operations (also known as tracking, telemetry, and commanding or "TT&C"). This will provide DOD with additional flexibility in the band 1755-1850 MHz to accommodate systems displaced from the band 1710-1755 MHz.<sup>4</sup>

<sup>1</sup>See *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems*, ET Docket No. 00-258, *Second Report and Order*, 17 FCC Rcd 23193 (2002) ("AWS Second Report and Order").

<sup>2</sup>*Id.*; *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems*, ET Docket No. 00-258, *Fourth Notice of Proposed Rulemaking*, 18 FCC Rcd 13235 (2003) ("AWS Fourth NPRM"). AWS is the collective term that we use for new and advanced wireless applications, such as voice, data and broadband services provided over a variety of high-speed fixed and mobile networks, and which are popularly referred to as 3G systems. We have also adopted service rules for AWS operations in the bands 1710-1755 MHz and 2110-2155 MHz. See *Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands*, WT Docket No. 02-353, *Report and Order*, 18 FCC Rcd 25162 (2003) ("AWS Service Rules R&O").

<sup>3</sup>See NTIA Report, "An Assessment of the Viability of Accommodating Advanced Mobile Wireless (3G) Systems in the 1710-1770 MHz and 2110-2170 MHz Bands," dated July 22, 2002 ("2002 Viability Assessment") (incorporated into the docket of this proceeding and available from NTIA at <http://www.ntia.doc.gov/ntiahome/threeg/va7222002/3Gva072202web.htm>). The Commission, which is an independent agency, administers non-Federal Government spectrum. NTIA, which is an operating unit of the U.S. Department of Commerce, administers Federal Government spectrum. See 47 C.F.R. § 2.105.

<sup>4</sup>*Id.* at 3.

- We permit the DOD to operate stations in the fixed and mobile except aeronautical mobile services in the band 2025-2110 MHz on a secondary basis at six sites in the southwestern region of the United States.
- We rescind the recently established rules for the Wireless Communications Services ("WCS") at 2385-2390 MHz and no longer make the band 2390-2400 MHz available for use by Unlicensed Personal Communications Services ("UPCS"). We also allow Federal and non-Federal Government flight test stations to operate in the band 2385-2395 MHz, which in turn will permit DOD to relocate all aeronautical mobile systems out of the band 1710-1755 MHz. In addition, these allocation changes provide needed replacement spectrum for use by DOD and commercial flight test stations, which recently lost access to 35 megahertz of spectrum at 1525-1535 MHz and 2320-2345 MHz.<sup>5</sup>

## II. BACKGROUND

4. In this Report and Order, we undertake a narrow and specific task – the reaccommodation of Federal Government users in order to make the 1710-1755 MHz band available for AWS use. However, the decisions we make herein are part of a larger and substantially more complex proceeding. The quest to make spectrum available for a variety of new and innovative wireless services has involved a variety of bodies, including this Commission, Federal Government stakeholders as represented through NTIA, and Congress.

5. In the Omnibus Budget Reconciliation Act of 1993 ("OBRA-93"), Congress directed the Secretary of Commerce to identify at least 200 megahertz of spectrum below 5 GHz for transfer to non-Federal Government services.<sup>6</sup> NTIA identified 235 megahertz, including the bands 1710-1755 MHz and 2390-2400 MHz, for such transfer.<sup>7</sup> At that time, the band 1710-1755 MHz, which was a Federal Government exclusive band, was to be reallocated as a mixed-use band.<sup>8</sup> Specifically, Federal Government use of the band 1710-1755 MHz was to remain protected indefinitely at 333 fixed microwave stations used by Federal power agencies, as required by 47 U.S.C. § 923(c)(4), and would additionally be protected indefinitely at 111 stations used for aviation-related safety communications and at 16 sites used by DOD for fixed point-to-point microwave, tactical radio relay, aeronautical mobile stations, etc.<sup>9</sup>

6. In July 2002, NTIA released its *2002 Viability Assessment*, which concluded that if certain actions were accomplished, the band 1710-1755 MHz could be reallocated for AWS use without disrupting communications systems critical to national security and that this spectrum could be paired

<sup>5</sup>See *Amendment of Parts 2, 25, and 87 of the Commission's Rules to Implement Decisions from World Radiocommunication Conferences Concerning Frequency Bands Between 28 MHz and 36 GHz and to Otherwise Update the Rules in this Frequency Range*, ET Docket No. 02-305, *Report and Order*, 18 FCC Rcd 23426 (2003) ("*Above 28 MHz R&O*"), at ¶¶ 20, 40.

<sup>6</sup>See OBRA-93, § 6001(a) (47 U.S.C. § 923(a)-(b)).

<sup>7</sup>See *Spectrum Reallocation Final Report, Response to Title VI – Omnibus Reconsideration Act of 1993*, NTIA Special Publication 95-32, dated February 1995.

<sup>8</sup>A mixed-use band means that Federal Government stations are limited by geographic area, by time, or by other means so as to guarantee that the potential use of the band to be made by such Federal Government stations is substantially less than the potential use to be made by non-Federal Government stations. See 47 U.S.C. 932(b)(2)(B).

<sup>9</sup>See OBRA-93, § 6001(a) (47 U.S.C. § 923(c)(4)); *supra* n. 7 at Appendix E and page F-4.

with spectrum from the band 2110-2170 MHz.<sup>10</sup> Specifically, except as provided below, Federal users of the band 1710-1755 MHz would relocate or modify their operations, not later than December 2008, or sooner depending on the nature of the radio communications.<sup>11</sup> In order to achieve these outcomes, the following actions would be required:

- (1) **Federal Non-Military Systems:** NTIA would direct the relocation of Federal non-military systems from the band 1710-1755 MHz to other Federal Government bands. Federal agencies that operate systems in the band 1710-1755 MHz that are required to relocate under the Omnibus Budget Reconciliation Act of 1993 are entitled to reimbursement from private sector entities receiving spectrum in that band. Federal agencies with protected assignments have agreed voluntarily to relocate such assignments, if reimbursed. All such systems are anticipated to vacate within two years after availability of reimbursed funds, or sooner if practicable.
- (2) **DOD Fixed Microwave Systems:** DOD would relocate its conventional fixed microwave systems from the band 1710-1755 MHz to other frequency bands within two years after reimbursement, but no later than December 2008, depending on the complexity of the relocated systems.
- (3) **DOD's 16 Protected Sites:**
  - (a) **DOD Airborne Telemetry & Video Systems:** Subject to the availability of reimbursement funds, DOD would relocate its airborne operations by December 2008 to other frequency bands, such as the Federal Government band 1755-1850 MHz, the Federal/non-Federal Government shared band 2360-2385 MHz or other telemetry bands; or the band 2385-2395 MHz under primary status provided as a result of a Commission rulemaking for Federal Government mobile use. NTIA will work with DOD to facilitate the introduction of new and relocated systems into the bands identified above.
  - (b) **DOD Ground-Based Systems:** The Commission would accomplish the necessary rulemaking so that DOD ground-based systems in the band 1710-1755 MHz can remain on a secondary basis at all sites, but on a primary basis at the Cherry Point, NC, and Yuma, AZ sites for operations used in a manner similar to current operations at these protected sites. DOD ground-based systems, other than Digital Wideband Transmission System operations at Cherry Point and Yuma, which cannot adjust their operations to prevent interference to commercial users in the band 1710-1755 MHz, will operate in the band 1755-1850 MHz or on a "non-interference, coordinated

<sup>10</sup>See *2002 Viability Assessment* at 1-2.

<sup>11</sup>The December 2008 relocation date in the *2002 Viability Assessment* was based on the existing statutory provisions for reimbursement and assumptions about when an auction might occur for the band 1710-1755 MHz. Once reimbursement and auction matters for that band have been resolved, we will be able to revisit the December 2008 relocation date as necessary.

basis" in the band 1350-2690 MHz.<sup>12</sup> DOD ground-based systems may operate in the band 2025-2110 MHz on a secondary basis at six sites.<sup>13</sup>

- (c) Future DOD Requirements in the Band 1755-1850 MHz: Considering that DOD has future requirements to satisfy in the band 1755-1850 MHz, plus the absorption of certain operations from the band 1710-1755 MHz, the Commission would conclude the necessary rulemaking by September 2004 to modify footnote US346 of the United States Table of Frequency Allocations to allow DOD the use of the band 2025-2110 MHz on a co-equal, primary basis for DOD TT&C earth stations at 11 selected sites that support DOD space operations.<sup>14</sup> Co-equal, primary access for TT&C in the band 2025-2110 MHz may make more spectrum available in the band 1755-1850 MHz to satisfy future DOD spectrum requirements.<sup>15</sup>
  - (d) DOD Precision Guided Munitions ("PGM") Operations: PGM operations would continue in the band 1710-1720 MHz on a primary basis until inventory is exhausted or until December 31, 2008, whichever is earlier.
  - (e) Other DOD Systems: Other DOD systems (e.g., unmanned ground robotic systems, range timing distribution systems, and target scoring devices) would relocate to the band 1755-1850 MHz, or other bands as available.
- (4) Implementing Coordination: NTIA, DOD, the Commission, and industry will establish a continuing process to facilitate sharing in the band 1710-1755 MHz. It is anticipated that the Commission will complete the necessary rulemakings to address the above conditions for making the band essentially clear of DOD operations at the protected sites, as well as reallocation of the band from Federal

<sup>12</sup> A non-interference, coordinated basis means that the military services may operate systems without an allocation in certain non-Federal Government bands subject to local coordination. Local coordination between FCC field personnel and military field personnel is described in the *NTIA Manual* at Section 7.15.3 (Military Communications in non-Government Bands Above 25 MHz for Tactical and Training Operations) and in Section 7.17 (Military Communications at Test Ranges in non-Government Bands Above 25 MHz). No change is contemplated in these well-established procedures. See *NTIA Manual of Regulations & Procedures for Federal Radio Frequency Management*, May 2004 Revision ("*NTIA Manual*"), Sections 7.15.3 and 7.17. The *NTIA Manual* can be downloaded at <http://www.ntia.doc.gov/osmhome/redbook/redbook.html>.

<sup>13</sup> Originally, NTIA requested that the military services be permitted to operate ground-based systems in mostly remote areas and ranges throughout the Southwestern United States, including, but not limited to, China Lake, CA; the Pacific Missile Test Range, Pt. Mugu, CA; Ft. Irwin, CA; Holloman AFB, NM (NTIA later renamed this site as the White Sands Missile Range); and Yuma, AZ. Subsequently, NTIA, with the concurrence of DOD, clarified that "ground-based systems" should be more narrowly defined as "stations in the fixed and mobile except aeronautical mobile services" and agreed to limit this use to the above five sites plus Nellis AFB, NV. These clarifications were made by W. Russell Slye, Office of Spectrum Management, NTIA to Chief, Spectrum Coordination Branch, Office of Engineering and Technology ("OET"), FCC, on September 24, 2002, October 9, 2002, and March 27, 2003.

<sup>14</sup> We recognize here that the DOD TT&C uplink earth stations provide TT&C functions not only for military systems, but for other Federal Government systems as well, such as those operated in the Space Research and Earth Exploration-Satellite Services.

<sup>15</sup> NTIA has indicated that effective relocation of Federal Government operations will depend not only on co-equal, primary access to spectrum in the bands 2025-2110 MHz and 2360-2395 MHz, but also on legislation to create a relocation fund using auction proceeds, and on the conduct of the auction. See Letter to the Honorable Richard B. Cheney, President of the Senate (and identically to other Members of the House and Senate), from Michael D. Gallagher, Acting Assistant Secretary for Communications and Information, United States Department of Commerce, NTIA (rel. Apr. 14, 2004) (reporting further actions needed in the allocation of spectrum to the civilian sector for the effective deployment of third generation (3G) wireless devices in the United States).

Government exclusive use to both Federal and non-Federal Government use on a mixed-use basis. It is expected that the early rollout of AWS will occur in the urban areas. Assuming reimbursed funds are available, every effort will be made to clear these areas first.

On July 24, 2002, we sought comment on the *2002 Viability Assessment*.<sup>16</sup>

7. In November 2002, we adopted the *AWS Second Report and Order*, wherein we allocated 90 megahertz of spectrum at 1710-1755 MHz and 2110-2155 MHz that can be used for AWS. The *AWS Second Report and Order* concluded that the *2002 Viability Assessment* offered a means to free the 1710-1755 MHz band of encumbrances in a timely and predictable manner, but did not address specific band-clearing proposals. Instead, in June 2003, we adopted the *AWS Fourth NPRM*, in which we proposed to make spectrum available for Federal Government operations that will be displaced from the band 1710-1850 MHz in order to relocate existing Federal Government operations in the 1710-1755 MHz segment (and, thus, ultimately facilitate the introduction of AWS in the 90 MHz of spectrum consisting of the 1710-1755 MHz and 2110-2155 MHz bands that was allocated in the *AWS Second Report and Order*).<sup>17</sup> As discussed in greater detail below, these proposals were consistent with the *2002 Viability Assessment* and were designed to provide a means by which incumbent Federal Government users in the 1710-1755 MHz band could relocate existing operations in order to allow for the deployment of AWS.

### III. DISCUSSION

#### A. The Band 2025-2110 MHz (2 GHz)

##### 1. Background

8. The band 1990-2110 MHz is currently used extensively by the Television Broadcast Auxiliary Service ("BAS") for mobile TV pickup ("TVPU") operations, including electronic newsgathering ("ENG") operations to cover events of interest and will be used for ENG operations of digital television stations.<sup>18</sup> The band may also be used for mobile operations in the Cable Television Relay Service ("CARS").<sup>19</sup> It is also used by fixed BAS operations such as studio-transmitter link ("STL") stations, TV relay stations, and TV translator relay stations, but the majority of those operations are in higher frequency bands allocated to the BAS.<sup>20</sup> Further, communications common carriers in the Local Television Transmission Service ("LTTS") may be assigned any of the BAS channels in the band

<sup>16</sup>See *Public Notice*, DA 02-1780, rel. July 24, 2002.

<sup>17</sup>See *supra* n. 1 & 2.

<sup>18</sup>A TVPU station is a land mobile station used for the transmission of TV program material and related communications from scenes of events back to the TV station or studio. See 47 C.F.R. § 74.601(a) (listing classes of TV broadcast auxiliary stations).

<sup>19</sup>47 C.F.R. § 78.18(a)(6).

<sup>20</sup>A TV STL station (studio-transmitter link) is a fixed station used for the transmission of TV program material and related communications from the studio to the transmitter. A TV relay station is a fixed station used for transmission of TV program material and related communications for use by TV broadcast stations or other purposes as authorized in Section 74.631. A TV translator relay station is a fixed station used for relaying programs and signals of TV stations to TV translators or other communications facilities that the Commission may authorize. See 47 C.F.R. § 74.601(b)-(d). See generally 47 C.F.R. § 74.600 ("Eligibility for license").

1990-2110 MHz to provide service to TV broadcast stations, TV broadcast network-entities, cable system operators, and cable network entities.<sup>21</sup>

9. Traditionally, the BAS channel plan divided the band 1990-2110 MHz into seven channels, each consisting of between 16.5 and 18 megahertz.<sup>22</sup> In 1997, as part of the *MSS Second Report and Order*, the Commission reallocated the 1990-2025 MHz segment to the mobile-satellite service ("MSS") and established a plan to reduce the seven-channel 120 megahertz BAS allocation in the band 1990-2110 MHz to a seven-channel 85 megahertz allocation in the 2025-2110 MHz (i.e., 2 GHz) segment.<sup>23</sup> The plan maintained the existing seven BAS channels by narrowing the width of each channel, and established a two-phase relocation plan to accomplish this transition.<sup>24</sup> More recently, we reallocated 15 MHz of this spectrum to support fixed and mobile services, including AWS,<sup>25</sup> and modified the BAS relocation plan to account for the fact that both MSS and Fixed and Mobile services will be using the band 1990-2025 MHz.<sup>26</sup> The entire band 1990-2110 MHz is still being used by BAS stations at this time.

<sup>21</sup> LTTS operations are limited to the permissible uses described in Sections 74.631 and 78.11. See 47 C.F.R. §101.803(b). For simplicity, in the remainder of this document the BAS, LTTS, and CARS services collectively will be referred to as BAS.

<sup>22</sup> The existing channel plan is as follows: Channel 1 (1990-2008 MHz), Channel 2 (2008-2025 MHz), Channel 3 (2025-2042 MHz), Channel 4 (2042-2059 MHz), Channel 5 (2059-2076 MHz), Channel 6 (2076-2093 MHz), and Channel 7 (2093-2110 MHz).

<sup>23</sup> See *Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for use by the Mobile-Satellite Service*, ET Docket No. 95-18, *Second Report and Order and Second Memorandum Opinion and Order*, 15 FCC Rcd 12315 (2000) ("*MSS Second Report and Order*").

<sup>24</sup> The Commission also identified four broad categories of BAS markets and specified relocation transition periods for the different markets. See *MSS Second Report and Order*, 15 FCC Rcd 12322-23, ¶ 19.

<sup>25</sup> *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems*, ET Docket No. 00-258, *Third Report and Order, Third Notice of Proposed Rulemaking, and Second Memorandum Opinion and Order*, 18 FCC Rcd 2223 (2003) ("*AWS Third Report and Order*").

<sup>26</sup> See *Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for use by the Mobile Satellite Service*, ET Docket No. 95-18, *Third Report and Order and Third Memorandum Opinion and Order*, 18 FCC Rcd 23638 (2003) ("*MSS Third Report and Order*"). The *MSS Third Report and Order*, *inter alia*, set forth a one-phase relocation by which BAS incumbents will be moved to channels in the 2025-2110 MHz band in a single step. See *MSS Third Report and Order*, 18 FCC Rcd at 23669-70, paras. 62-64. See also *Improving Public Safety Communications in the 800 MHz Band, Consolidating the 800 and 900 MHz Industrial/Land Transportation and Business Pool Channels, Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems*, WT Docket No. 02-55, ET Docket No. 00-258, RM-9498, RM-10024, & ET Docket No. 95-18, *Report and Order, Fifth Report and Order, Fourth Memorandum Opinion and Order, and Order*, FCC 04-168, (rel. Aug. 6, 2004) ("*800 MHz/Nextel Order*") (modifying the plan for relocation of BAS incumbents from the band 1990-2025 MHz to accommodate the entry of Nextel Communications, Inc., in the 1990-1995 MHz band segment); *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems, Petition for Rule Making of the Wireless Information Networks Forum Concerning the Unlicensed Personal Communications Service, Petition for Rule Making of UTStarcom, Inc., Concerning the Unlicensed Personal Communications Service, Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for use by the Mobile-Satellite Service*, ET Docket No. 00-258, RM-9498, RM-10024, ET Docket No. 95-18, *Sixth Report and Order, Third Memorandum Opinion and Order, and Fifth Memorandum Opinion and Order*, (continued....)

10. The 2 GHz band is also allocated to the Earth Exploration-Satellite Service ("EESS") and Space Research Service on a primary basis for Federal and non-Federal Government use, limited to uplink and space-to-space transmissions. Further, the band is allocated to the Space Operation Service on a primary basis, for Federal Government use, limited to uplink and space-to-space transmissions. The Commission has adopted international power flux-density limits at the Earth's surface for the band in order to protect non-Federal Government terrestrial operations from satellite transmissions. The Commission has also adopted international footnote 5.391 prohibiting high-density mobile systems in the band, which facilitates compatible operations between non-Federal Government terrestrial transmitting stations and spacecraft receivers.

## 2. Proposals

11. In the *AWS Fourth NPRM*, we proposed to revise footnote US346 to permit DOD to operate TT&C transmit earth stations<sup>27</sup> at the 11 sites requested by NTIA on a co-equal, primary basis with BAS operations in the 2 GHz band. We noted that 2 GHz is the principal TT&C uplink band outside of the United States and that the proposed action would better harmonize U.S. military space operations with the rest of the world. Specifically, our proposal was designed to give DOD the option of moving any or all of its TT&C uplinks at 11 specific sites up in frequency from 1761-1842 MHz to 2 GHz in order to clear spectrum in a geographic area for other military systems, including fixed and mobile systems that must be relocated out of the band 1710-1755 MHz into the band 1755-1850 MHz. We also noted that satellites already in orbit cannot be changed to the new 2 GHz frequencies because they are hardwired to receive in the band 1761-1842 MHz. We proposed to revise footnote US346 to read as follows:<sup>28</sup>

US346 Except as provided for below and by footnote US222, Federal Government use of the band 2025-2110 MHz by the space operation service (Earth-to-space), Earth exploration-satellite service (Earth-to-space), and space research service (Earth-to-space) shall not constrain the deployment of the Television Broadcast Auxiliary Service, the Cable Television Relay Service, or the Local Television Transmission Service. To facilitate compatible operations between non-Federal Government terrestrial receiving stations and Federal Government earth station transmitters, coordination is required. To facilitate compatible operations between non-Federal Government terrestrial transmitting stations and Federal Government spacecraft receivers, the terrestrial transmitters shall not be high-density systems (see Recommendations ITU-R SA.1154 and ITU-R F.1247). Military satellite control stations at the following sites shall operate on a co-equal, primary basis with non-Federal Government operations:

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(...continued from previous page)

FCC 04-219 (rel. Sep. 22, 2004) ("*AWS Sixth R&O*") (redesignating the bands 1995-2000 MHz and 2020-2025 MHz for AWS use).

<sup>27</sup> An earth station is, *inter alia*, a station located on the Earth's surface and intended for communication with one or more space stations. See *ITU Radio Regulations*, Edition of 2001, No. 1.63.

<sup>28</sup> *AWS Fourth NPRM* at ¶ 26.



Facility	Coordinates	
Naval Satellite Control Network, Prospect Harbor, ME	44° 24' 55" N	068° 00' 50" W
New Hampshire Tracking Station, New Boston AFS, NH	42° 56' 52" N	071° 37' 37" W
Eastern Vehicle Check-out Facility & GPS Ground Antenna & Monitoring Station, Cape Canaveral, FL	28° 29' 10" N	080° 34' 34" W
Buckley AFB, CO	39° 42' 55" N	104° 46' 29" W
Colorado Tracking Station, Schriever AFB, CO	38° 48' 21" N	104° 03' 43" W
Kirtland AFB, NM	35° 03' 00" N	106° 24' 00" W
Camp Parks Communications Annex, Pleasanton, CA	37° 44' 00" N	121° 52' 00" W
Naval Satellite Control Network, Laguna Peak, CA	34° 06' 55" N	119° 04' 50" W
Vandenberg Tracking Station, Vandenberg AFB, CA	34° 49' 24" N	120° 31' 54" W
Hawaii Tracking Station, Kaena Pt, Oahu, HI	21° 33' 48" N	158° 14' 54" W
Guam Tracking Stations, Anderson AFB, and Naval CTS, Guam	13° 36' 48" N	144° 51' 12" E

12. In the *AWS Fourth NPRM*, we noted that 2 GHz is the primary band used by TV broadcasters to transmit live news via ENG equipment. Specifically, our licensing records show that there are more than 1000 TVPU and CARS units, and LTTS mobiles/temporary fixed stations<sup>29</sup> operating in that band. Further, we observed that DOD TT&C earth stations use extremely large antennas and high transmitter output powers to produce highly focused and very powerful mainbeams that could potentially cause interference to 2 GHz BAS operations. Accordingly, we found that coordination would be necessary between the two services. In this regard, we stated that we would maintain our longstanding policy that first-licensed facilities have the right of protection from later-licensed facilities operating in the same frequency band. We observed that Federal Government earth stations at 29 sites are currently authorized to transmit in the 2 GHz band and stated that we believed that, with coordination, an additional 11 sites could also successfully share that band. We based that belief on a variety of factors that could facilitate sharing of the 2 GHz band, including terrain shielding, TT&C channels generally being used for relatively short periods of time, some TT&C antennas being pointed out to sea, and other TT&C antennas being pointed at high elevation angles.<sup>30</sup>

13. We also noted in the *AWS Fourth NPRM* that, in a Federal/non-Federal Government shared band, DOD would ordinarily follow NTIA's procedures in securing coordination, *i.e.*, NTIA would approve the change in frequency for the earth stations and submit the frequency change to the Commission through the Frequency Assignment Subcommittee ("FAS") of NTIA's Interdepartment Radio Advisory Committee. Commission engineers would then provide input to ensure that incumbent non-Federal Government operations would be protected. However, in this case, we proposed to require that operation of the TT&C earth stations not be authorized in the absence of successful prior coordination between DOD and the affected BAS incumbents. We noted that the band 1990-2110 MHz supports a mix of mobile TVPU stations and fixed links and that BAS stations are currently transitioning to narrower channels in the 2 GHz band to accommodate new services at 1990-2025 MHz. In addition, because each local TV market may transition to a new BAS channel plan at different times, we stated that local frequency coordinators may be in the best position to assess requests that affect local operating conditions. Thus, we proposed to require that, prior to submitting applications for the authorization of the 11 earth stations to the Commission through the FAS, DOD frequency coordinators and technical representatives work with the local frequency coordinator (in most cases, this would be the Society of Broadcast Engineers, Inc. ("SBE")) and the affected BAS licensees to ensure that the DOD operations not cause interference to incumbent non-Federal Government operations.

<sup>29</sup>These are mainly news trucks, but other vehicles, such as news helicopters and blimps, are also included.

<sup>30</sup>*AWS Fourth NPRM* at ¶¶ 28-30.

14. We stated in the *AWS Fourth NPRM* that we expected that it may be necessary to jointly establish with NTIA other non-standard coordination procedures during the course of this proceeding. We sought comment on coordination procedures that can be implemented that will ensure that both fixed and mobile BAS stations are adequately protected and accommodate the introduction of Federal Government earth stations in this band.<sup>31</sup> We acknowledged that the short geographic separations between the 11 DOD transmit earth station sites and nearby cities in which BAS operations are conducted present coordination challenges, and we sought comment on how these challenges can be addressed.<sup>32</sup> We recognized that our Rules do not currently include coordination rules that protect the normal operating areas of TVPU stations, but expressed the belief that coordination between the parties is achievable for the 11 DOD transmit earth stations without adversely affecting TVPU operations. We stated that, while we do not believe that non-Federal Government operations are likely to cause interference to Federal Government operations, we will require that once a DOD earth station has been coordinated, new BAS stations within these 11 areas coordinate their systems with the local DOD facility.<sup>33</sup>

15. In the *AWS Fourth NPRM*, we observed that NTIA has added to the *NTIA Manual* the operational limits specified in the ITU *Radio Regulations* for DOD earth stations operating in the band 1761-1842 MHz. We stated that we anticipated that NTIA would update the *NTIA Manual* to require that DOD earth stations operating in the 2 GHz band conform to these limits.<sup>34</sup>

16. In the *AWS Fourth NPRM*, we also expressed concern that, because the frequency bands adjacent to the 2 GHz band (1990-2025 MHz and 2110-2155 MHz) have been reallocated for fixed and mobile services, interference could be caused to future operations in these services due to the placement of the TT&C earth stations. We requested comment on what out-of-band emission ("OOBE") limits would be sufficient to protect the mobile and fixed receivers that will operate in this spectrum and also requested comment on the potential for these receivers to experience overload interference.<sup>35</sup>

17. Finally, we proposed in the *AWS Fourth NPRM* to permit DOD to operate 2 GHz stations in the fixed and mobile except aeronautical mobile services on a secondary basis at six sites identified by NTIA in the southwestern United States. We noted that NTIA believes that, because these operations are usually in remote areas, it appears feasible for DOD to operate on a coordinated basis in the 2 GHz band. We stated that we agreed with NTIA's assessment and also stated that it appears feasible to operate

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<sup>31</sup>The BAS also includes short term operations conducted pursuant to Section 74.24. Short term operations are TVPU or temporary fixed operations performed outside the parameters of a station's authorization, allowed for up to 720 hours per year, and can be conducted by all licensees of broadcast stations under Part 73 and broadcast auxiliary stations provided under subparts D, E, F, and H of Part 74, except wireless video assist devices, under the authority conveyed by a Part 73 license or a broadcast auxiliary license. 47 C.F.R. § 74.24 (Short term operation). Short term operations may be used by network entities to implement nationwide operation, and are sometimes referred to as "itinerant" or "network itinerant" operations.

<sup>32</sup>We noted, for example, that the Buckley AFB, CO, Kirtland AFB, NM, Pleasanton, CA, and Laguna Peak, CA, DOD earth station sites were separated from the nearest city limits of the metropolitan areas of Denver, CO, Albuquerque-Santa Fe, NM, San Francisco-Oakland-San Jose, CA, and Los Angeles, CA, by 1, 5, 10, and 20 miles, respectively. See *AWS Fourth NPRM* at ¶ 29.

<sup>33</sup>*AWS Fourth NPRM* at ¶ 31.

<sup>34</sup>*Id.* at ¶ 32.

<sup>35</sup>*Id.* at ¶¶ 34-37.

stations in the maritime service in the Pacific Missile Test Range/Pt. Mugu on a secondary basis without hindering BAS fixed and mobile operations. We requested comment on this tentative finding.<sup>36</sup>

### 3. Comments

18. Ericsson Inc ("Ericsson") supports the proposals set forth in the *AWS Fourth NPRM*, including allocation of the 2 GHz band for the 11 DOD TT&C uplink earth stations. Ericsson states that this band can accommodate Federal Government operations and will permit the band 1710-1755 MHz to be used for AWS systems.<sup>37</sup>

19. Space Imaging LLC ("Space Imaging") agrees that there are good public interest reasons for giving DOD the option of moving certain uplinks into the 2 GHz band, but notes that the U.S. commercial remote-sensing satellite industry also uses that band for TT&C uplink operations in the EESS on a non-interference basis under footnote US347. Space Imaging therefore urges the Commission and DOD to ensure that future DOD deployments in that band will protect the TT&C operations of the U.S. commercial remote-sensing satellite licensees.<sup>38</sup> Specifically, Space Imaging recommends that DOD be required to consult with these remote-sensing licensees prior to moving its TT&C uplinks to the 2 GHz band.<sup>39</sup>

20. SBE opposes our proposal to allow TT&C uplinks in the 2 GHz band. It states that it does not understand why the DOD TT&C uplinks cannot remain in the present 1761-1842 MHz band, with DOD users of the band 1710-1755 MHz being relocated into the higher TT&C band. SBE contends that this would be a far more feasible frequency sharing plan than attempting to relocate high-power TT&C uplinks to the 2 GHz band. SBE maintains that moving those uplinks to that band would pose a serious interference threat to the ability of TV BAS operators to use co-channel frequencies for ENG in the vicinity of the uplinks. It further maintains that the use of filters and selective receivers by TV BAS operators would not eliminate harmful interference because of this co-channel sharing.<sup>40</sup> SBE contends that, because a substantial portion of ENG operations is analog, a desired/undesired ("D/U") signal ratio of 60 dB<sup>41</sup> or better is needed to ensure no harmful interference from a co-channel TT&C uplink to an ENG-receive-only ("ENG-RO") site. It contends that if an ENG-RO antenna is aimed at both an ENG truck and a TT&C uplink, the ENG-RO receiver may achieve a D/U ratio of only 5-15 dB, or even lower.<sup>42</sup> It argues that the Commission is proposing a fundamentally incompatible sharing plan that is unlikely to succeed, at least as long as broadcasters are using analog ENG links. SBE asserts that, once broadcasters have converted to digital ENG, the D/U ratio can probably be relaxed from 60 dB to 30 dB and, for some of the 11 TT&C sites that are not in the vicinity of major TV markets with extensive ENG operations, co-channel sharing may become feasible. SBE concedes that, since it appears that it will be several years for TT&C uplinks to be shifted to 2 GHz, this may be possible but only with care.<sup>43</sup> Finally,

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<sup>36</sup>*Id.* at ¶ 38.

<sup>37</sup>Ericsson Comments at 1-3.

<sup>38</sup>Space Imaging Comments at 1-3.

<sup>39</sup>*Id.* at 9-10.

<sup>40</sup>SBE Comments at 1-2.

<sup>41</sup>A dB (short for decibel) measures the relative difference in power, with each 10 dB representing a 10-fold difference. Thus, 60 dB represents a million-fold difference in power.

<sup>42</sup>SBE Comments at 2-3.

<sup>43</sup>*Id.* at 5.

SBE contends that most of the geographic coordinates listed in the *AWS Fourth NPRM* for the 11 TT&C sites are incorrect.<sup>44</sup>

21. The National Association of Broadcasters and Association for Maximum Service Television, Inc. ("NAB/MSTV") contend that it is impossible for the Commission to accurately assess the potential impact on TV BAS operations of relocating the 11 DOD TT&C uplinks to the 2 GHz band because NTIA has not yet released details on the technical parameters of these uplinks.<sup>45</sup> However, NAB/MSTV state that, if the following conditions are imposed, they could accept such a relocation:

- 1) NTIA must disclose detailed information on the technical parameters of the 11 TT&C uplinks;
- 2) The broadcast industry must, based on that information, make a full and accurate assessment of the potential for interference into BAS facilities and thereby determine that successful coordination among DOD and BAS facilities is a realistic possibility; and
- 3) The Commission must place strict limits on the output power levels of the 11 TT&C uplinks.<sup>46</sup>

22. Gannett Co., Inc. ("Gannett"), the licensee of KUSA-TV in Denver, CO, provides showings describing a high risk of interference to BAS ENG facilities. Gannett argues that KUSA-TV's BAS facilities would be rendered essentially inoperable by a DOD TT&C uplink at Buckley AFB, CO. It thus urges the Commission to consider several alternatives to the relocation of TT&C to the 2 GHz band in the Denver area:

- 1) relocate or narrowband TT&C within the existing 1755-1850 MHz allocation;
- 2) relocate the Buckley AFB TT&C uplink away from Denver;
- 3) reduce TT&C power;
- 4) reduce TT&C antenna sidelobes with "pie-plate shrouds;" or
- 5) raise the lower limit of the TT&C antenna elevation above the horizon.<sup>47</sup>

23. The Cellular Telecommunications & Internet Association ("CTIA") supports a 2 GHz allocation for the 11 DOD TT&C uplink earth stations, provided that adjacent band operations are protected.<sup>48</sup> Cingular Wireless LLC ("Cingular") also generally supports the proposed 2 GHz allocation, but expresses concern about the potential for OOB and receiver overload interference to affect AWS operations at 2110-2155 MHz and PCS operations at 1930-1995 MHz.<sup>49</sup> Cingular notes that several of the DOD TT&C locations are located close to large metropolitan areas and suggests that it may be necessary to limit TT&C operation to the central portion of the 2 GHz band.<sup>50</sup> Cingular recommends that the Commission clarify the exact OOB limits that will apply to the systems to be deployed at 2 GHz. With regard to controlling the potential for TT&C transmitters to cause overload interference to adjacent band

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<sup>44</sup>*Id.* at 8-10.

<sup>45</sup>NAB/MSTV Comments at Summary.

<sup>46</sup>*Id.* at 13-14.

<sup>47</sup>Gannett Comments at 3.

<sup>48</sup>CTIA Comments at 2-3.

<sup>49</sup>Cingular Comments at 3-4.

<sup>50</sup>*Id.* at 9.

fixed and mobile receivers, Cingular states that the Commission should consider the existing Universal Mobile Telephone Service receiver standards that exist in Europe in the band 2110-2170 MHz.<sup>51</sup>

24. Motorola, Inc. ("Motorola") suggests restricting TT&C use of the top 12 megahertz of the 2 GHz band (2098-2110 MHz) and adopting transmitter filtering requirements to address the concern that DOD TT&C earth station operations will cause interference to AWS operations in the adjacent 2110-2155 MHz band.<sup>52</sup> Motorola notes, however, that because the proposed TT&C operations would be at a limited number of sites, the Commission could alternatively implement coordination procedures that would consider the specific operations and propagation losses in the vicinity of each earth station. Motorola states that interference concerns to adjacent band services could be addressed by utilizing mitigation techniques such as power control, operation of earth stations at higher elevation angles, baseband filtering, and frequency offsets. Motorola recommends that the Commission require coordination between DOD and AWS licensees in the band 2110-2120 MHz to limit interference from earth station transmitters utilizing the upper portion of the 2 GHz band. Motorola states that this can be achieved by adding AWS in the band 2110-2120 MHz to the list of services that require coordination in footnote US346.<sup>53</sup> Motorola also recommends that, because OOB will impact all AWS licensees, the Commission work with industry, NTIA, and DOD to develop a baseband filtering requirement for DOD earth station transmitters, which should then be adopted as a new out-of-band emission limit in the *NTIA Manual*. Motorola also supports the proposal set forth in the *AWS Fourth NPRM* to allow DOD to operate fixed and mobile (except aeronautical mobile) stations in the 2 GHz band on a secondary basis at six sites in the southwestern United States. However, Motorola recommends that the proposed footnote be modified to make clear that the new allocation will have a secondary status.<sup>54</sup>

25. In reply comments, Motorola contends that the comments of the broadcasting community recognize that use of a combination of interference mitigation techniques may be sufficient to enable successful sharing of the 2 GHz band. It also contends that conversion to digital BAS operations will significantly reduce the potential for interference to ENG receivers. Moreover, Motorola argues that new satellite transponders incorporating 2 GHz TT&C frequencies will not be available for a number of years, and that any migration of DOD uplinks to 2 GHz will not be feasible until at least 2010 or beyond. Furthermore, Motorola argues, even after transponders become available, satellites that are currently in orbit will continue to utilize only the band 1761-1842 MHz until the end of their operational lives because it is not feasible to make the hardware modifications necessary to allow them to utilize the 2 GHz band. Motorola contends that, according to DOD, the migration will be completed no earlier than 2020.<sup>55</sup>

26. In reply comments, SBE states that it supports requiring DOD to coordinate with Space Imaging's existing 2 GHz EESS uplinks for any of DOD's new 2 GHz TT&C uplinks that are to be located in the vicinity of the existing uplinks.<sup>56</sup> SBE also notes that ENG is a critical tool used by broadcasters to inform the public in emergency situations, and that, in the event of a serious terrorist incident, increased activity on DOD TT&C uplinks could occur at the time of heaviest use of 2 GHz

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<sup>51</sup>*Id.* at 9-10.

<sup>52</sup>Motorola Comments at 2-3.

<sup>53</sup>*Id.* at 5.

<sup>54</sup>*Id.* at 5-6.

<sup>55</sup>Motorola Reply Comments at 3-5.

<sup>56</sup>SBE Reply Comments at 3. In an *ex parte* filing, SBE supplies geographic coordinates and related information on many BAS ENG TVPU receive sites that are within 150 km of DOD TT&C earth stations. See SBE *ex parte* filing, filed May 10, 2004.

TV BAS frequencies. SBE therefore contends that authorizing DOD TT&C use of the 2 GHz band could impact homeland security.<sup>57</sup>

#### 4. Decision

27. *DOD Co-Primary Use of 2 GHz Band.* We are adopting, with minor changes, the proposals for the 2 GHz band set forth in the AWS Fourth NPRM. In so doing, we recognize the concerns of the broadcasting community that sharing of that band by TV BAS stations and DOD TT&C uplink earth stations will be challenging in some instances. However, we are confident that such sharing is feasible and will promote the public interest, particularly in the ultimate provision of AWS to the public, provided that coordination procedures adequate to the protection of both incumbent BAS stations and DOD TT&C uplink earth stations are imposed. In this regard, we are maintaining in the 2 GHz band our longstanding policy that first-licensed facilities have the right of protection from later-licensed facilities operating in the same band.<sup>58</sup> This means that a new DOD TT&C uplink earth station seeking to operate at 2 GHz must coordinate with all BAS stations that may be affected by the new earth station's operation. To ensure that the right of protection of first-licensed facilities is adequately maintained, we conclude that it is necessary to ensure that not too long a period of time elapses between the authorization and the commencement of operations of a DOD TT&C uplink earth station at 2 GHz. Thus, DOD must coordinate facilities at the 11 sites only when construction and/or implementation are anticipated, and prior to authorization. To ensure that such coordination occurs successfully, prior to authorization, DOD must coordinate the DOD TT&C uplink earth station with all potentially affected incumbent BAS, CARS, and LTTS licensees of stations within the coordination contour of the earth station, consistent with Appendix 7 of the ITU Radio Regulations, and engage the local BAS frequency coordinator(s), where available, in support of achieving such coordination.<sup>59</sup> DOD, at the time it submits its application for the authorization of a 2 GHz earth station to the Commission through NTIA's FAS, must provide, with its application, a list of the entities with which coordination was undertaken. For those rare situations where no reasonable coordination can be negotiated, the issue may be raised to the FCC and NTIA to jointly arbitrate resolution. We will not concur with authorizing operation of any 2 GHz DOD TT&C uplink earth station in the absence of successful coordination between DOD and the affected BAS incumbents. Once the DOD TT&C uplink earth station has begun coordination, new BAS, CARS, and LTTS stations for which coordination begins later must accept interference from the DOD earth station, as is normally the case for new stations sharing spectrum on a co-primary basis.<sup>60</sup> Finally, to ensure that future BAS, CARS, and LTTS licensees have a means for coordinating their proposed operations with the DOD TT&C uplink earth station, DOD earth stations must maintain a point of contact for coordination.<sup>61</sup>

<sup>57</sup>*Id.* at 6.

<sup>58</sup>See, e.g., *Amendment of Parts 2 and 90 of the Commission's Rules to Provide for Narrowband Private Land Mobile Radio Channels in the 150.0-150.8 MHz, 162-174 MHz, and 406.1-420 MHz Bands that are Allocated for Federal Government Use*, ET Docket No. 04-243, *Notice of Proposed Rulemaking*, FCC 04-165 (rel. July 6, 2004) ¶ 40. See also 47 C.F.R. §§ 2.104(d)(3)(iii), 2.105(c)(2)(iii).

<sup>59</sup>Local BAS frequency coordinators may not be available in all areas. We note that SBE maintains a list of local frequency coordinators, by county, on its website at <http://www.sbe.org>.

<sup>60</sup>We note that new BAS, CARS, and LTTS stations may coordinate with the DOD earth station using regular coordination procedures appropriate to their services. See 47 C.F.R. §§ 74.638 (c) and (d), 78.36 (c) and (d), and 101.103.

<sup>61</sup>The above requirements have been confirmed by the NTIA. See Letter to Edmond J. Thomas, Chief, Office of Engineering and Technology, Federal Communications Commission, from Frederick R. Wentland, Associate Administrator, Office of Spectrum Management, National Telecommunications and Information Administration, United States Department of Commerce (dated Sep. 15, 2004) ("*NTIA Letter*").

28. Accordingly, we adopt revisions generally as proposed for footnote US346. Additionally, we have corrected some of the geographic coordinates for the 11 DOD earth stations, originally listed in proposed footnote US346, and we have made several editorial changes to the footnote.<sup>62</sup> The adopted footnote US346 reads as follows:

US346 Except as provided for below and by footnote US222, Federal use of the band 2025-2110 MHz by the space operation service (Earth-to-space), Earth exploration-satellite service (Earth-to-space), and space research service (Earth-to-space) shall not constrain the deployment of the Television Broadcast Auxiliary Service, the Cable Television Relay Service, or the Local Television Transmission Service. To facilitate compatible operations between non-Federal terrestrial receiving stations at fixed sites and Federal earth station transmitters, coordination is required. To facilitate compatible operations between non-Federal terrestrial transmitting stations and Federal spacecraft receivers, the terrestrial transmitters in the band 2025-2110 MHz shall not be high-density systems (see Recommendations ITU-R SA.1154 and ITU-R F.1247). Military satellite control stations at the following sites shall operate on a co-equal, primary basis with non-Federal operations:

Facility	Coordinates	
Naval Satellite Control Network, Prospect Harbor, ME	44° 24' 16" N	068° 00' 46" W
New Hampshire Tracking Station, New Boston AFS, NH	42° 56' 52" N	071° 37' 36" W
Eastern Vehicle Check-out Facility & GPS Ground Antenna & Monitoring Station, Cape Canaveral, FL	28° 29' 09" N	080° 34' 33" W
Buckley AFB, CO	39° 42' 55" N	104° 46' 36" W
Colorado Tracking Station, Schriever AFB, CO	38° 48' 21" N	104° 31' 43" W
Kirtland AFB, NM	34° 59' 46" N	106° 30' 28" W
Camp Parks Communications Annex, Pleasanton, CA	37° 43' 51" N	121° 52' 50" W
Naval Satellite Control Network, Laguna Peak, CA	34° 06' 31" N	119° 03' 53" W
Vandenberg Tracking Station, Vandenberg AFB, CA	34° 49' 21" N	120° 30' 07" W
Hawaii Tracking Station, Kaena Pt, Oahu, HI	21° 33' 44" N	158° 14' 31" W
Guam Tracking Stations, Anderson AFB, and Naval CTS, Guam	13° 36' 54" N	144° 51' 18" E

29. We acknowledge that recent data supplied by SBE indicate that there may be a significant potential for interference from DOD TT&C earth stations at the 11 sites that may use the 2 GHz band into 2 GHz fixed receive-only receivers used in connection with BAS ENG TVPUs.<sup>63</sup> However, as indicated

<sup>62</sup>*Id.* We have also restored the phrase "at fixed sites" in the second sentence of footnote US346. That phrase was inadvertently omitted from the version of footnote US346 proposed in the *AWS Fourth NPRM*. Finally, we have deleted the word "Government" from any references to Federal Government or non-Federal Government in the footnote.

<sup>63</sup>For example, we note that a DOD TT&C uplink earth station using the maximum transmitter power of 40 dBW, bandwidth of 4 MHz, and a 46 foot antenna as described in the *DOD IMT-2000 Assessment* at ¶ B.4.2.1.2, with its main beam elevated 3 degrees above the horizon plane, would produce an effective isotropic radiated power ("EIRP") as high as 58 dBW in the horizon plane. Under unobstructed line of sight (LOS) conditions, an EIRP produces an isotropic receive power, RXI (in dBW), at a point located a distance D from the transmitter, given by  $RXI = EIRP - (92.4 + 20\log_{10}(F) + 20\log_{10}(D))$ , where F is the frequency (in GHz) and D is the distance (in km) (The expression within the parentheses is usually referred to as the Free Space Loss ("FSL")). For EIRP = 58 dBW in the horizon plane and F = 2.07 GHz (*i.e.*, a frequency in the center of the 2 GHz band), at distances D of 20, 50, 100, and 200 km, the above expression yields RXI's of -66.7, -74.7, -80.7, and -86.7 dBW, respectively.

The maximum permissible isotropic receive power of interference present at a receive antenna, MAXRXI, to avert degrading the receiver noise threshold, is given by  $MAXRXI = 10\log_{10}(kTB) + NF + (I/N) + LR - GR$ , where k is  
(continued....)

in the *AWS Fourth NPRM*, sharing techniques currently exist that should enable 2 GHz earth stations to be engineered into the 11 sites without harming existing BAS operations. We also acknowledge that some sharing situations will be difficult and may require more restrictive techniques, such as limiting power, limiting the pointing direction and elevation of the DOD earth station, constructing berms or installing RF shielding, arranging time-sharing agreements for DOD use during off-peak hours when TV BAS use is at a minimum, and other mitigation techniques.<sup>64</sup> Nonetheless, because these techniques, together with coordination with potentially affected licensees, can facilitate implementation of the DOD TT&C earth stations at the 11 sites, we see no insurmountable technical obstacles that would prevent us from implementing the proposed 2 GHz allocation.

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Boltzman's constant ( $1.38 \times 10^{-23}$  joules/K, or  $1.38 \times 10^{-17}$  W/(MHzK)),  $T$  is the receive antenna temperature (usually 290 K),  $B$  is the receiver bandwidth (in MHz),  $NF$  is the receiver noise figure (in dB),  $(I/N)$  is the maximum interference-to-noise ratio (in dB) required to avert degrading the receiver noise threshold,  $LR$  is the line loss (in dB) between the output of the receive antenna and the receiver, and  $GR$  is the isotropic gain (in dB) of the receive antenna (in dB). For a typical BAS ENG TV Pickup receiver, as described in the *DOD IMT-2000 Assessment* at ¶¶ B.7.2.2.1 and C.6.1.1.1, with a bandwidth of 17 MHz, a noise figure of 3 dB, an  $(I/N)$  of -9 dB (to avert a receiver noise threshold degradation exceeding 0.5 dB), a line loss of 2 dB, and an isotropic antenna gain of 22 dB (main beam, no sidelobe suppression), the above expression yields a MAXRXI of -157.7 dBW. We adjust this figure downward 1.5 dB, to account for the 12 MHz receiver bandwidth consistent with the new BAS channel plan, to -159.2 dBW.

The above-calculated RXI's of the DOD TT&C uplink earth station horizon plane interfering signal, with an EIRP of 58 dBW, at distances  $D$  of 20, 50, 100, and 200 km, exceed MAXRXI for a BAS ENG TV Pickup receiver by 92.5, 86.5, 80.5, and 72.5 dB, respectively, representing significant worst case interference potentials. Analysis of the SBE data indicates such interference potentials, often in multiple directions, around several of the eleven TT&C sites, due to LOS or near LOS conditions owing to the height of ENG receive antennas with respect to their surroundings, whether on tall buildings or towers in urban areas or on mountain sites, in order to obtain maximum visibility from potential ENG transmit locations. Under this worst case analysis, the Buckley AFB site, in particular, exhibits numerous interference potentials, ranging from 71 to 95 dB, into ENG receive antennas located around downtown Denver, generally southwest, west, and northeast of Buckley, all at distances from 15 to 18 km. In addition, several interference potentials, ranging from 79 to 87 dB, occur at mountain sites located west and northwest of Buckley, at distances from 40 to 100 km. These sites could pose a challenge because their antennas may tend to point eastward and southeastward, toward Denver and its suburbs, and therefore toward Buckley AFB, located just east of Denver, during most of their use.

We emphasize, however, that these potentials are typically worst case, with the TT&C uplink at maximum power, which could be reduced by as much as 20 dB, and antenna pointing within 3 degrees of the horizon plane, where more restrictive, skyward pointing, such as to the GSO arc, could offer an improvement up to 40 dB, or more through antenna redesign to increase sidelobe suppression. TT&C site mitigation could also include construction of berms and other attenuating features, as well as taking advantage of existing manmade and terrain obstructions. Further, on-going case-by-case coordination with BAS ENG operations has the potential to take advantage of the fact that the TT&C antenna spends relatively little time pointing in a particular direction, much less at an elevation of 3 degrees; of a typical ENG receive antenna sidelobe suppression of 20 dB, where the antenna main beam pointing need not be toward the TT&C earth station; and/or operation on adjacent ENG channels, where they are available. Finally, we note that, during on-going coordination, receiver threshold degradation, on which this worst case was based, may be supplanted by less stringent criteria which fully consider actual ENG power, modulation, performance, or other requirements, as were considered by Gannett, NAB, and SBE in their comments.

<sup>64</sup>DOD, in conjunction with broadcasters, will be able to come to agreement determining which actions may be appropriate to protect incumbent BAS operations, particularly BAS ENG TVPU deployments, from interference. These measures might, for example, involve adjustments to earth station antenna power and pointing, satellite orbit coverage, or times of operation, to reduce radiation in the direction of terrestrial facilities.



30. We also observe that, as noted by Motorola, interference to 2 GHz TV BAS stations from DOD earth stations will not be an immediate issue because DOD satellites incorporating those frequencies will not be available for at least several years. Further, to ensure mission success, NTIA anticipates that new satellites will be built with dual tracking and command frequencies, *i.e.*, in both the band 1761-1842 MHz and the 2 GHz band. As DOD gains experience with TT&C operations in the 2 GHz band, use of the band 1761-1842 MHz for TT&C is expected to be reduced, but DOD requirements in that band may exist until the year 2030.<sup>65</sup> Therefore, initial DOD use of the 2 GHz band is not expected to involve either immediate or full relocation of the current systems. However, enabling relocation of DOD operation from the band 1761-1842 MHz to the 2 GHz band will over time allow DOD the flexibility to accommodate additional systems in the band 1755-1850 MHz. Finally, DOD may choose not to use the 2 GHz band for some of its 11 existing sites that currently operate in the band 1761-1842 MHz due to coordination difficulties with incumbent operations.

31. Additionally, we observe that, by the time DOD earth stations begin to use the 2 GHz band, total or near-total conversion to digital BAS operations is likely to have occurred.<sup>66</sup> That conversion promises to significantly reduce the potential for interference to BAS receivers because the digital technology to be used for BAS is far more robust than analog technology against undesired signals. As noted by SBE, use of digital technology by BAS licensees may permit the BAS D/U ratio to be relaxed by several orders of magnitude in some cases.<sup>67</sup> While it is not possible to precisely forecast when digital BAS operations will be used in a particular geographic area, it is also not possible to precisely forecast when a DOD earth station may begin to use 2 GHz frequencies in that area. Given the uncertain timeframe for DOD implementation of the 2 GHz allocation for the 11 sites, possibly extending many years into the future, it may be appropriate for us to establish the specifics of a coordination process that will accommodate future developments, such as the digital conversion of BAS operations.

32. With regard to Gannett's specific concern about the DOD site at Buckley AFB, CO, we will not impose *a priori* conditions that would restrict DOD's options at that site. We find that requiring coordination to protect incumbent operations and maintaining flexibility on specific technical requirements will allow the spectrum sharing situation to be customized to meet the requirements at the time when DOD needs to use this spectrum.

33. Regarding the technical characteristics of the DOD TT&C operations, we observe that NTIA has updated the *NTIA Manual* to require that DOD TT&C earth stations operating in the band 2025-2110 MHz conform to operational limits specified in the ITU *Radio Regulations* for that band.<sup>68</sup> These limits require that an earth station not transmit until the mainbeam of its antenna is pointing at least 3° above the horizon, unless affected parties have agreed to a lower elevation angle.<sup>69</sup> In addition, we

<sup>65</sup>See Department of Defense's "Investigation of the Feasibility of Accommodating the International Mobile Telecommunications (IMT) 2000 Within the 1755-1850 MHz Band," dated February 9, 2001, at page 2-2 ("*DOD IMT-2000 Assessment*").

<sup>66</sup>We note that the recently adopted *800 MHz/Nextel Order* provides a means to relocate BAS incumbents to new channels in the band 2025-2110 MHz in a relatively quick period of time, and we expect such relocation to incorporate transition to digital operations. See *supra* n. 26.

<sup>67</sup>SBE Comments at 5.

<sup>68</sup>See *NTIA Manual*, Section 8.2.35 (Power and Direction of Maximum Radiation of Earth Stations in Certain Bands Shared with Stations in the Fixed and Mobile Services) at ¶¶ 1, 2, 4, 5, and 7; see also ITU *Radio Regulations*, Article 21.

<sup>69</sup>Specifically, "earth station antennas shall not be employed for transmission at elevation angles of less than 3° measured from the horizontal plane to the direction of maximum radiation, except when agreed to by agencies or (continued....)

observe that NTIA has adopted the ITU limit on the EIRP transmitted in any direction towards the horizon by an earth station. Specifically, these limits require that an earth station be:

- 1) limited to an EIRP of 40 dBW<sup>70</sup> at a 0° elevation angle, in any 4 kHz band;
- 2) permitted to increase its EIRP to 40 dBW plus 3 times their elevation angle between 0-5°, in any 4 kHz band;
- 3) unlimited in EIRP at elevation angles above 5°; and
- 4) restricted from exceeding these EIRP limits by more than 10 dB.<sup>71</sup>

While these technical characteristics give an idea of how DOD TT&C operations might operate if they were constructed today, the situation may change before the operations are ready to be constructed for the 2 GHz band. Therefore, we find that a flexible approach regarding technical requirements backed up with coordination to protect incumbent operations is the best approach to sharing the 2 GHz band. This will allow DOD to take advantage of the latest technological capabilities to achieve sharing with BAS operations and will allow them to consider any changes in BAS equipment or use that might occur between now and when DOD needs access to this spectrum.

34. *Adjacent Band Services.* We reject Cingular's suggestion that DOD operations be limited to the central portion of the 2 GHz band because we find that it is technically feasible for those operations to use the entire band without causing interference to adjacent band fixed and mobile services. In this regard, we find that techniques such as power control, operation of earth stations at higher elevation angles, baseband filtering, berms or RF shielding, and other techniques, as well as frequency offsets, can mitigate interference from 2 GHz DOD earth stations to adjacent band fixed and mobile services at 1930-2025 MHz and 2110-2155 MHz.<sup>72</sup> We also reject Motorola's recommendations that we add AWS in the upper adjacent band 2110-2120 MHz to the list of services that require coordination in footnote US346, or increase OOB limits for DOD 2 GHz earth stations. NTIA and DOD state that DOD 2 GHz earth stations' compliance with the OOB limits in the *NTIA Manual* should provide adequate protection to out-of-band users.<sup>73</sup> However, we recognize the likelihood that a variety of factors - such as high

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administrations concerned and those whose services may be affected." See *NTIA Manual*, Section 8.2.35 at ¶ 7; see also *ITU Radio Regulations*, No. 21.14. Because lower elevation angles for the earth station's antenna equate to larger geographic areas in which BAS operations may be impacted, it is especially important that BAS licensees and other affected parties would have to concur with any proposal to reduce the elevation angle below 3°.

<sup>70</sup>A dBW is a unit of power relative to a watt, with 0 dBW equaling 1 watt. Each 10 dBW above or below 0 dBW represents a respective ten-fold increase or decrease in power. Thus, 40 dBW equals 10,000 watts, or 10 kilowatts.

<sup>71</sup>See *NTIA Manual*, Section 8.2.35 at ¶¶ 1, 2, and 4; see also *ITU Radio Regulations*, No. 21.8, 21.9, and 21.11. We also note that NTIA has revised the earth station emission mask for frequencies below 15 GHz to specify a minimum attenuation of spectral density, below the highest spectral density in any 4 kHz band within the necessary bandwidth, of 8 dB at the edge of the necessary bandwidth, i.e., at a frequency removed from the center of the emission bandwidth by half the necessary bandwidth. Attenuation roll-off remains, unchanged, 40 dB per decade (12 dB per octave) of half the necessary bandwidth, reaching a maximum attenuation of 60 dB. We note that this occurs at a frequency removed from the center of the emission bandwidth by ten times the necessary bandwidth. See *NTIA Manual*, Section 5.6.2.

<sup>72</sup>We currently are addressing use of the band 1990-2025 MHz and have adopted service rules for the band 2110-2155 MHz. See *MSS Third Report and Order*; *AWS Third Report and Order*, ¶¶ 28-37, 68-70. See also *AWS Sixth R&O*; *Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands*, WT Docket No. 04-356 ("AWS 2 GHz Service Rules NPRM").

<sup>73</sup>See *NTIA Letter*. Further, we have previously noted that NTIA has revised the Federal Government earth station emission mask for frequencies below 15 GHz. See *supra* n. 71. In addition, as requested by Cingular in its

(continued....)

power operation on a frequency close to the adjacent band, combined with a momentarily low beam elevation angle to acquire or maintain communications with a non-geostationary satellite orbit ("NGSO") satellite as it passes through elevation angles just above the horizon in a certain direction - may occur, increasing the potential for interference to AWS users in that direction. We accept NTIA's and DOD's position that additional measures will not generally be needed. However, we expect that DOD will be cognizant of the potential for interference into AWS operations in the adjacent band 2120-2155 MHz and take appropriate steps to control such interference for specific situations at DOD TT&C earth stations. In this regard, we note that the same measures exercised by the DOD 2 GHz earth station to protect BAS facilities, such as maintaining high elevation angles and erecting berms as described above, should similarly mitigate against adjacent band interference with AWS operating in the same areas. We will address protection of new services in the lower adjacent band 2020-2025 MHz, which has been allocated for use by Fixed and Mobile services on a primary basis, in a future decision.<sup>74</sup>

35. Finally, with regard to the potential for 2 GHz DOD earth stations to cause overload interference to adjacent band receivers, we recognize this potential but note that at present it is unclear what type of receivers will be used in these adjacent bands when DOD transmitters commence operations in several years. Further, as suggested by Cingular, the record in this proceeding is not sufficiently developed to warrant the adoption of receiver interference immunity standards at this time. However, we urge industry to contemplate the future development of such standards and will revisit this issue if the situation warrants.

36. *Secondary DOD Use of 2 GHz Band.* We find that permitting DOD to operate 2 GHz stations in the fixed and mobile except aeronautical mobile services on a secondary basis at six sites is in the public interest. These sites are all at remote locations in the southwestern United States and can operate without hindering 2 GHz BAS fixed and mobile operations. We are adopting Motorola's recommendation that we modify the wording of our proposed new footnote to clarify the status of the military operations and make some other minor editorial changes to the footnote. Accordingly, that footnote will read as follows:

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Comments at 9, concerning the potential for interference from BAS systems in the band 2025-2110 MHz to AWS systems in the band 2110-2155 MHz, we confirm that the BAS digital emission mask in Section 74.637(a)(2)(iii) specifies a spectral density floor of -43 dBW/4 kHz, equivalent to -13 dBm/4 kHz, -19 dBW/MHz, or +11 dBm/MHz, for frequencies removed from the assigned frequency by more than 250 percent of authorized bandwidth, regardless of the measurement resolution bandwidth used.

We also take this opportunity to remind prospective AWS licensees that, as we noted in the *AWS Service Rules R&O* ¶ 116, the band 2110-2120 MHz is allocated on a primary basis for Earth-to-space (deep space) communications in the Space Research Service used by the National Aeronautics and Space Administration ("NASA"). Operations in this service in the United States are limited to deep space communications at the NASA Goldstone Deep Space Network ("DSN") facility in Goldstone, California. AWS licensees will be permitted to operate in the area around Goldstone without having to provide protection to the facility. However, operation of AWS systems will be affected by transmissions from Goldstone. In the *AWS Allocation Order* ¶ 33, we concluded that because of the nature of operations at Goldstone, a significant amount of interference should not occur to AWS systems operating in the 2110-2120 MHz band in the vicinity of Goldstone. However, AWS licensees using the 2110-2120 MHz band should be aware that this facility may operate at any time at a nominal EIRP of 105.5 dBW, and under emergency conditions up to 119.5 dBW, along any azimuth, and at elevations as low as 10 degrees above the horizon. During these transmissions, AWS systems operating in the vicinity of Goldstone may become unavailable. AWS licensees cannot claim protection from interference due to these transmissions. We thus note that future AWS licensees operating in spectrum in the 2110-2120 MHz band in the area surrounding Goldstone, California should consider this potential for interference in developing their systems.

<sup>74</sup>See *AWS Third Report and Order*, ¶¶ 28-37, 68-70. See also *AWS Sixth R&O*; *AWS 2 GHz Service Rules NPRM*.

US391 In the band 2025-2110, military services may operate stations in the fixed and mobile except aeronautical mobile services on a secondary basis at the sites listed below. Upon request, primary users must provide sufficient information to allow secondary military users to protect the primary operations.

Site	Coordinates	Radius of Operation (km)
Nellis AFB, NV.....	36° 14' N 115° 02' W	80
China Lake, CA.....	35° 41' N 117° 41' W	50
Ft. Irwin, CA.....	35° 16' N 116° 41' W	50
Pacific Missile Test Range/Pt. Mugu, CA	34° 07' N 119° 30' W	80
Yuma, AZ.....	32° 32' N 113° 58' W	80
White Sands Missile Range, NM.....	33° 00' N 106° 30' W	80

37. *EESS Use of 2 GHz Band.* We are not requiring DOD to frequency coordinate its new 2 GHz uplink earth stations with existing 2 GHz EESS uplinks that operate under US347. While we concur with Space Imaging that it and other commercial remote-sensing operators use the 2 GHz band for important purposes, their operations are on a non-interference basis, and such users of a frequency band do not have the right to be protected from interference caused by new, primary users of that same band. However, we urge DOD, prior to commencing 2 GHz operations, to consult with remote-sensing licensees that operate under US347. We observe that it is in DOD's self-interest to do so because these remote sensing licensees perform significant defense and intelligence work.<sup>75</sup>

#### *B. The Band 2360-2400 MHz*

##### 1. Background

38. In the United States, the principal use of the band 2360-2390 MHz is for aeronautical telemetry operations. In response to the Balanced Budget Act of 1997, the band 2385-2390 MHz was transferred from Federal/non-Federal Government shared use to non-Federal Government exclusive use, effective January 1, 2005, except that Federal and non-Federal Government aeronautical telemetry operations may continue on a primary basis at various sites for two additional years. We codified this spectrum transfer through the adoption of footnote US363. Concurrently, we allocated the band 2385-2390 MHz to the non-Federal Government fixed service on a primary basis, removed limitations on the use of the existing non-Federal Government mobile service allocation by deleting the band 2385-2390 MHz from footnote US276, and deleted the Federal Government mobile, fixed, and radiolocation service allocations from the band 2385-2390 MHz. We subsequently established service rules under Part 27 for this band.<sup>76</sup> However, the band 2385-2390 MHz has not yet been auctioned or licensed for new fixed and mobile services; instead, as authorized by footnote US363, this spectrum is still used by flight test stations. In order to accommodate aeronautical mobile systems relocated from the band 1710-1755 MHz, NTIA now requests that the band 2385-2390 MHz be generally returned to its allocation status prior to the reallocation.

39. In the United States, the band 2390-2400 MHz was historically part of a larger band that extended from 2390-2450 MHz, which was allocated to the radiolocation service on a primary basis for use by the

<sup>75</sup>Space Imaging Comments at 2, 8-9.

<sup>76</sup>See *Reallocation of the 216-220 MHz, 1390-1395 MHz, 1427-1429 MHz, 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz Government Transfer Bands*, ET Docket No. 00-221, *Report and Order*, 17 FCC Rcd 368 (2002).

military services and to the amateur service on a secondary basis. In 1994, the Commission reallocated the band 2390-2400 MHz, which was transferred as exclusive non-Federal Government spectrum, to the amateur service on a primary basis.<sup>77</sup> At the request of NTIA, the Commission concurrently added footnote G122 to its Rules, which states that Federal Government operations may be authorized on a non-interference basis in the band 2390-2400 MHz.<sup>78</sup> Also concurrent with that transfer, the Commission made the band 2390-2400 MHz available for UPCS devices and established technical rules for their use. In general, UPCS devices operating in the band 2390-2400 MHz were limited to asynchronous devices, which are devices that transmit RF energy in short bursts of time, as typified by packet data transmissions used in local area network systems.<sup>79</sup> The Commission revised Part 15 of its Rules to allow asynchronous devices to operate in the band 2390-2400 MHz using the same rules as are used for the band 1910-1920 MHz.<sup>80</sup>

## 2. Proposals

40. In the *AWS Fourth NPRM*, we proposed to permit Federal Government aeronautical mobile systems to operate throughout the band 2360-2395 MHz. However, we noted in the *AWS Fourth NPRM* that non-Federal Government flight test station operations have been rapidly increasing, and so we proposed to permit those operations to share the band 2385-2395 MHz with Federal Government aeronautical mobile systems.<sup>81</sup> In order to implement our proposal, we proposed to allocate the band 2385-2395 MHz to the mobile service on a primary basis for Federal Government use and to modify footnote US276 to include the band 2385-2395 MHz, to permit Federal agencies to conduct all types of aeronautical mobile operations, not just aeronautical telemetering and telecommand operations, and to permit non-Federal Government users to conduct aeronautical mobile operations, limited to aeronautical telemetering and associated telecommand operations for flight testing, in the band 2385-2395 MHz. We also proposed to expand the permissible uses under the Federal Government mobile service allocation in the band 2360-2395 MHz to include land mobile and maritime mobile applications on a secondary basis to aeronautical mobile applications. We further proposed to allocate the band 2385-2390 MHz to the radiolocation service on a primary basis and to the fixed service on a secondary basis for Federal Government use and to revise footnote G122 so that Federal Government operations in the band 2390-2395 MHz would no longer be shown as being on a non-interference basis to non-Federal Government operations.<sup>82</sup>

41. In the *AWS Fourth NPRM*, we observed that, under our proposal, the amateur service would retain its current primary allocation at 2390-2400 MHz, but would be required to share the lower 5 megahertz with new Federal and non-Federal Government operations on a co-primary basis.<sup>83</sup> We solicited comment on whether limits should be imposed on the amateur and/or mobile services in order to enhance spectrum sharing. We also observed that non-Federal Government flight test stations in the band 2310-2390 MHz have long been subject to the emission limitations that are specified in Section 87.139 of

<sup>77</sup>See *Allocation of Spectrum Below 5 GHz Transferred from Federal Government Use*, ET Docket No. 94-32, *First Report and Order and Second Notice of Proposed Rule Making*, 10 FCC Rcd 4769 (1995).

<sup>78</sup>See 47 C.F.R. § 2.106, footnote G122.

<sup>79</sup>See 47 C.F.R. § 15.303(a).

<sup>80</sup>See 47 C.F.R. §§ 15.301; 15.303(g); 15.319(a); and 15.321(a), (b), and (g).

<sup>81</sup>*AWS Fourth NPRM* at ¶¶ 40-44.

<sup>82</sup>*Id.* at ¶¶ 55-56, 58.

<sup>83</sup>We also proposed a conforming amendment to Section 97.303(j)(2)(iii) of our amateur Rules to reflect this spectrum sharing proposal. See 47 C.F.R. § 97.303(j)(2)(iii)

our Rules, and we proposed to continue to employ these emission limitations for non-Federal Government flight test stations in the band 2385-2390 MHz. We requested comment on the appropriate out-of-band emission limits that are necessary to protect the Satellite Digital Audio Radio Service ("DARS") at 2320-2345 MHz from harmful interference caused by either aeronautical ground or aircraft stations. Finally, we proposed to rescind numerous changes to our WCS service rules at 2385-2390 MHz because that band will no longer be available for WCS and to no longer make the band 2390-2400 MHz available for UPCS because there is no UPCS equipment authorized or anticipated in that band.<sup>84</sup>

### 3. Comments

42. Motorola supports the proposed allocation changes to accommodate Federal airborne telemetry systems in the band 2360-2400 MHz. Motorola maintains that the proposed changes would enable DOD to relocate all of the airborne telemetry and video systems that currently operate in the band 1710-1755 MHz to the band 2360-2395 MHz, and that these changes are critical to the deployment of AWS in the band 1710-1755 MHz. It contends that this proposed allocation for airborne telemetry would be consistent with uses of this spectrum in other countries and would thus promote harmonization with international spectrum allocations.<sup>85</sup> The Aerospace and Flight Test Radio Coordinating Council ("AFTRCC") generally agrees with Motorola, stating that there is exponential growth in aerospace telemetry data rates and that this growth is driven by increasing complexity of technology surrounding the development of new equipment. AFTRCC also urges that new amateur use of the band 2390-2395 MHz be precluded and existing amateur use be grandfathered as secondary, arguing that there is no existing or proposed coordination procedure between flight test and amateur operations.<sup>86</sup>

43. Sirius Satellite Radio, Inc. and XM Radio, Inc. ("Sirius/XM") request that the Commission impose a sufficiently stringent limit on unwanted emissions from new aeronautical operations in the band 2360-2395 MHz to avoid harmful interference to Satellite DARS at 2320-2345 MHz. Sirius/XM state that Satellite DARS receivers are particularly susceptible to interference from the out-of-band energy of airborne transmitters because they employ very small aperture, near omnidirectional antennas and operate near the noise floor. Sirius/XM also state that, because airborne transmitters are always line-of-sight from Satellite DARS receivers, any interference would be pervasive and continuous. Sirius/XM contend that the proposed OBE limits on airborne transmitters of  $55 + 10 \log(p)$  dB would permit them to exceed the existing WCS to DARS interference OBE standard by as much as 55 dB. Sirius/XM assert that the resulting spurious energy would be far greater than the interference rejection capability in Satellite DARS receivers, and that it makes no sense to permit greater OBE from one service than another. Accordingly, Sirius/XM recommend that the Commission require all new Federal Government and non-Federal Government operators in the band 2360-2395 MHz to meet the OBE limits that apply to adjacent band WCS licensees. However, Sirius/XM concede that if aeronautical mobile transmitters satisfy a minimum altitude restriction, a lesser degree of OBE protection would be appropriate.<sup>87</sup>

<sup>84</sup> AWS Fourth NPRM at ¶¶ 59-63.

<sup>85</sup> Motorola Comments at 7-9.

<sup>86</sup> AFTRCC Comments at 3-5.

<sup>87</sup> Sirius/XM Comments at 2-6. In an ex parte filing, XM has subsequently withdrawn its proposals, regarding OBE limits, with respect to new non-Federal Government aeronautical mobile transmissions at 2360-2395 MHz, recognizing, based on discussions with AFTRCC, that the vast majority of these transmissions occur at altitudes high enough to avoid interference to Satellite DARS. However, XM maintains its proposals with respect to new fixed transmitters used in conjunction with new non-Federal Government aeronautical mobile operations, and all new Federal Government operations, at 2360-2395 MHz. See XM ex parte filing, filed August 17, 2004.

44. In reply comments, Motorola contends that it is notable that none of the commenters oppose the relocation of airborne telemetry operations to the band 2360-2395 MHz. It recommends that the Commission reject Sirius/XM's request for more stringent OOB limits to protect satellite DARS receivers because the operational characteristics of flight testing and airborne telemetry are different than for WCS and no basis has been established for applying the WCS OOB limits to aeronautical mobile operations in the band 2360-2395 MHz.<sup>88</sup>

45. AFTRCC similarly argues, in reply comments, that there is no basis for the OOB limits sought by Sirius/XM. It maintains that Sirius/XM accepted their allocation at 2320-2345 MHz knowing that flight testing was conducted at 2360-2390 MHz. It also asserts that a study it commissioned shows that a combination of operational and technical factors precludes the risk of flight test interference to satellite DARS reception. For example, AFTRCC contends that when an aircraft is visible during a flight test at high altitude, an extremely high gain antenna is required to pick up the telemetry signal. AFTRCC further asserts that since satellite DARS antennas are omnidirectional, their antenna gain is near zero, and thus the susceptibility to a telemetry signal is lower than if the DARS receiver antenna had a higher gain towards the telemetry transmitter. Further, AFTRCC contends that when an aircraft is at low altitude, ground attenuation and geographic separation between members of the general public and flight test operations ensure that the telemetry signal will be attenuated. In both scenarios, AFTRCC asserts, the flight test signal received in the DARS band will typically be far below the level requested by Sirius/XM for the flight test transmitter. It concludes that there is no basis for any new, more stringent OOB limits on flight testing relative to satellite DARS and that the *AWS Fourth NPRM* is correct in proposing to simply continue with the long-established Section 87.139 requirements for Non-Government flight testing. Finally, AFTRCC states that, subsequent to the filing of the comments responding to the *AWS Fourth NPRM*, discussions were initiated with the National Association for Amateur Radio (also known as the American Radio Relay League or "ARRL") relative to a possible accommodation of the interests of AFTRCC and ARRL in the band 2390-2395 MHz, and those parties will advise the Commission of the result of these discussions.<sup>89</sup> In this regard, in its *ex parte* filing of May 13, 2004, AFTRCC provides an update indicating that it has been unable to report completion of an agreement with the ARRL.<sup>90</sup> In an additional *ex parte* filing submitted 15 days later, AFTRCC describes the potential for interference from amateur operations, including point-to-point and prospective airborne amateur television ("ATV") operations, into aeronautical flight testing operations, especially telemetry air-to-ground links essential to aircrew safety, and urges that formal coordination of amateur operations be required or, alternatively, suggests the initiation of a rulemaking to upgrade the secondary amateur allocation in the band 2300-2305 MHz, in return for deletion of the amateur allocation in the band 2390-2395 MHz.<sup>91</sup> On

<sup>88</sup>Motorola Reply Comments at 8.

<sup>89</sup>AFTRCC Reply Comments at 2-4.

<sup>90</sup>See AFTRCC *ex parte* filing, filed May 13, 2004.

<sup>91</sup>See AFTRCC *ex parte* filing, filed May 28, 2004. AFTRCC describes ATV operation in the band 2390-2395 MHz, with bandwidth of 6 MHz (which we note extends into the greater band 2390-2400 MHz), and emphasis on transmitter power levels increasing to the 15-50 watt range; high gain antennas mounted at heights exceeding 40 feet; operational ranges increasing to 20-50 miles; and contests to demonstrate maximum possible power and range and minimal expense. AFTRCC also notes that there is an emphasis on ATV airborne operations in radio-controlled aircraft, ultralight and general aviation aircraft, balloons, and rockets. AFTRCC states that although literature on such operations deals mostly with lower frequency bands, particularly the 70 cm (420-450 MHz) band, these characteristics will of necessity apply to the band 2390-2395 MHz. AFTRCC describes the potential for high gain aeronautical mobile flight testing ground receivers, which employ large parabolic dishes designed to track aircraft and missiles operating 200 or more miles away, to receive interference from ATV point-to-point or airborne operations at great distance due to low antenna elevation angle and corresponding off-axis attenuation, and line-of-sight conditions, especially in the case of amateur airborne operations.